

CLAIMS

What is claimed is:

1. A method of automatically selecting MR data for image reconstruction comprising the steps of:

acquiring an image data set from each of a plurality of receiver coils;;
determining an index gauge for each image data set; the index gauge representing a spatial relationship between a given receiver coil and a desired FOV;
comparing the index gauges;
removing any image data set having an index gauge demonstrating a spatial relationship between the given receiver coil and the desired FOV that is less than optimal based on the comparison; and
reconstructing an image from a remaining imaging data sets.

2. The method of claim 1 wherein the plurality of receiver coils include a phased array coil assembly of a medical imaging scanner and the index gauges is an intensity value, and the step of removing any image data set is accomplished by one of:

projecting an intensity value for a given image data set onto an axis of the MR coils and conducting a profile fit;

calculating a center of mass of an intensity profile comprised of the intensity value; and

determining a peak location of the intensity profile along an axis of the receiving coils.

3. The method of claim 1 further comprising the step of determining an intensity value as the index gauge by determining an integration of a coil sensitivity profile weighted by a spin density of a scanning subject over the desired FOV for each receiver coil.

4. The method of claim 1 wherein the index gauge is determined by approximating a constant spin density according to:

$$G_i = \sum_{(x,y)} |S_i(x,y)M(x,y)| \approx M_o \sum_{(x,y)} |S_i(x,y)|$$

where $S_i(x,y)$ is a spatial sensitivity of an i-th MR coil of an N-coil phased coil array, and $M(x,y)$ is a spin magnetization density weighted by an imaging sequence, M_o is the approximated constant spin density, and where the summation is over all spatial pixels in a desired FOV.

5. The method of claim 1 wherein the index gauge is determined without assuming a constant spin density according to:

$$G_i = \sum_{(x,y)} \left(|I_i(x,y)| / \sum_i |I_i(x,y)| \right) = \sum_{(x,y)} \left(|S_i(x,y)| / \sum_i |S_i(x,y)| \right)$$

where $S_i(x,y)$ is a spatial sensitivity of an i-th MR coil of an N-coil phased coil array, $I_i(x,y)$ is a total intensity obtained from central k-space data for each MR coil, and wherein the summation is over all spatial pixels in a desired FOV.

6. The method of claim 1 wherein each step is performed automatically by a computer system, without a hardware landmark, and without user input.
7. The method of claim 1 further comprising the steps of:
determining an intensity threshold value; and
automatically forming an image reconstruction data set that includes the image data sets having an index gauge exceeding the threshold.
8. The method of claim 1 further comprising the steps of:
determining a receiver mean value for each receiver coil;
determining a total mean value with each of the receiver mean values;
and
selecting the receiver coils having a receiver mean value greater than a percentage of the total mean value.
9. The method of claim 1 wherein the step of determining an index gauge is further defined as extracting a relative intensity from each image data set.
10. The method of claim 1 wherein the receiver coils are phased array coils and wherein the index gauge is an intensity value of the image data set acquired for each coil, and further comprises:
arranging the intensity values for the image data set into an intensity profile; and

selecting a subset of the image data sets acquired for final image reconstruction.

11. The method of claim 7 wherein the steps of determining the intensity threshold value is determined on-the-fly based on the index gauges for the image data sets and further includes excluding an image data set with a least sensitivity of the FOV after comparing each index gauge to the intensity threshold value.

12. A method of automatically determining a subset of acquired data from a field-of-view of a receiver assembly having a number of coils comprising the steps of:

acquiring a number of images from a plurality of coils of an image field-of-view (FOV);

determining an image intensity for each of the number of images;

projecting the image intensity of each image onto a virtual axis of the plurality coils to create an intensity profile map; and

selecting a subset of images of the number of images acquired based on the intensity profile map.

13. The method of claim 12 further comprising the step of fitting each coil to the intensity profile map and reconstructing an image from the subset of images.

14. The method of claim 12 further comprising the step of determining a center of mass of the intensity profile map and reconstructing an image from the subset of images.
15. The method of claim 12 further comprising the step of determining a peak location of the intensity profile map along the virtual axis of the number of coils and reconstructing an image from the subset of images.
16. The method of claim 12 further comprising the step of determining a coil position at least partially outside the image FOV based on a number of coils positioned within the image FOV.
17. The method of claim 9 wherein the step of selecting a subset of images includes the step of comparing an image intensity to an image intensity threshold.
18. An MRI apparatus to reduce artifacts in reconstructed images comprising:
 - a magnetic resonance imaging (MRI) system having a plurality of coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit and receive RF signals to and from a multi-coil RF coil assembly to acquire MR images; and
 - a computer programmed to:

acquire an MR image from each coil of the multi-coil RF coil assembly across an image FOV;
determine an intensity value for each MR image;
differentiate the MR images acquired from each coil based on the intensity values to discard any MR image having excess data acquired outside the image FOV; and
reconstruct a final image by combining a remaining number of MR images.

19. The MRI apparatus of claim 18 wherein the computer is further programmed to:
project the intensity value of each MR image onto an axis of the multi-coil RF coil assembly; and
obtain, from the projection of the intensity value of each MR image, a coil position relative to the image FOV for each of the coils.

20. The MRI apparatus of claim 19 wherein the computer is further programmed to determine an intensity profile from the projection of each MR image onto the coils and is further configured to determine at least one of a peak intensity location of the intensity profile, a center of mass of the intensity profile, and fit the intensity profile to a coil map.

21. The MRI apparatus of claim 18 wherein the computer is further programmed to differentiate the MR images dynamically and without a hardware

landmark, and without a lookup table, and without user input parameters relating to differentiation.

22. The MRI apparatus of claim 18 wherein the computer is further programmed to isolate at least one MR image having an intensity value less than an intensity threshold that is determined based on the determined intensity values.

23. The MRI apparatus of claim 18 wherein the computer is further programmed to calculate an index gauge as the intensity value by approximating a constant spin density according to:

$$G_i = \sum_{(x,y)} |S_i(x,y)M(x,y)| \approx M_o \sum_{(x,y)} |S_i(x,y)|$$

where $S_i(x,y)$ is a spatial sensitivity of an i-th MR coil of an N-coil phased coil array, and $M(x,y)$ is a spin magnetization density weighted by an imaging sequence, M_o is the approximated constant spin density, and where the summation is over all spatial pixels in a desired FOV.

24. The MRI apparatus of claim 18 wherein the computer is further programmed to calculate an index gauge as the intensity value without assuming a constant spin density according to:

$$G_i = \sum_{(x,y)} \left(|I_i(x,y)|^f \sum_i |I_i(x,y)| \right) = \sum_{(x,y)} \left(|S_i(x,y)|^f \sum_i |S_i(x,y)| \right)$$

where $S_i(x,y)$ is a spatial sensitivity of an i -th MR coil of an N -coil phased coil array, $I_i(x,y)$ is a total intensity obtained from central k -space data for each MR coil, and wherein the summation is over all spatial pixels in a desired FOV.

25. The MRI apparatus of claim 18 wherein the computer is further programmed to exclude an MR image acquired from a coil that is at least partially outside the image FOV.

26. A computer program having a set of instructions that when executed by a computer causes the computer to:

- acquire a set of imaging data including a number of data frames;
- determine an intensity value for each data frame;
- determine an intensity index from each intensity value;
- form a reconstruction data set that only includes the data frames having an intensity value exceeding the intensity index; and
- reconstruct an image from the reconstruction data set.

27. The computer program of claim 26 wherein the set of instructions further causes the computer to acquire the set of reconstruction data from a plurality of data channels of a phased array coil assembly in a medical imaging scanner.

28. The computer program of claim 24 wherein the set of instructions further causes the computer to integrate a coil sensitivity profile weighted by a spin

density of a scanning subject over a field-of-view for each coil in the phased array coil assembly to determine the intensity value for each data frame.

29. The computer program of claim 27 wherein the set of instructions further causes the computer to:

determine a plurality of mean values for the plurality of data channels;
determine a total mean value from the plurality of mean values; and
select channels from the plurality of data channels having a mean value greater than a percentage of the total mean value.

30. The computer program of claim 26 wherein the set of instructions further causes the computer to determine an index gauge according to one of:

$$G_i = \sum_{(x,y)} |S_i(x,y)M(x,y)| \approx M_0 \sum_{(x,y)} |S_i(x,y)|$$

where $S_i(x,y)$ is a spatial sensitivity of an i-th MR coil of an N-coil phased coil array, and $M(x,y)$ is a spin magnetization density weighted by an imaging sequence, M_0 is the approximated constant spin density, approximating a constant spin density and where the summation is over all spatial pixels in a desired FOV; and

$$G_i = \sum_{(x,y)} \left(|I_i(x,y)| / \sum_i |I_i(x,y)| \right) = \sum_{(x,y)} \left(|S_i(x,y)| / \sum_i |S_i(x,y)| \right)$$

where $S_i(x,y)$ is a spatial sensitivity of an i-th MR coil of an N-coil phased coil array, $I_i(x,y)$ is a total intensity obtained from central k-space data for each MR coil, without assuming a constant spin density and wherein the summation is over all spatial pixels in a desired FOV.

31. An MR scanner comprising:

means for acquiring an image data set from each of a plurality of receiver coils;

means for determining an index gauge for each image data set;

means for comparing the index gauges;

means for removing any image data set having an index gauge demonstrating a spatial relationship between the given receiver coil and the desired FOV that is less than optimal based on the comparison; and

means for reconstructing an image from a remaining imaging data sets.